Better Buildings®
U.S. DEPARTMENT OF ENERGY

Better Buildings Residential Network
Peer Exchange Call Series

2-in-1: What Is the Potential for an Integrated Furnace & Water Heater?

October 27, 2022

Agenda and Ground Rules

- Agenda Review and Ground Rules
- Residential Network Overview and Upcoming Call Schedule
- Opening Poll
- Featured Speakers
  - **Edward Louie**, Pacific Northwest National Laboratory
  - **Dana Fischer**, Mitsubishi Electric US, Inc – Heating & Cooling
  - **Geoff Wickes**, Northwest Energy Efficiency Alliance
- Open Discussion
- Closing Poll and Announcements

Ground Rules:

1. **Sales of services and commercial messages are not appropriate** during Peer Exchange Calls.
2. Calls are a safe place for discussion; **please do not attribute information to individuals** on the call.

The views expressed by speakers are their own, and do not reflect those of the Dept. of Energy.

Join the Network

Member Benefits:

- Recognition in media, social media and publications
- Speaking opportunities
- Updates on latest trends
- Voluntary member initiatives
- One-on-One brainstorming conversations

Commitment:

- Members only need to provide *one number*: their organization's number of residential energy upgrades per year, or equivalent.

Upcoming Calls (2nd & 4th Thursdays):

- *11/10: Electric Vehicles and Residential Energy Efficiency: Preparing for the Historical Increase*
- *12/08: The Big Heat Pump Push – How are Programs, Contractors, and the Grid Responding?*

Peer Exchange Call summaries are posted on the Better Buildings website a few weeks after the call

Edward Louie

Pacific Northwest National Laboratory

U.S. DEPARTMENT OF ENERGY

Pacific Northwest
NATIONAL LABORATORY

What Is the Potential for an Integrated Furnace & Water Heater?

October 27, 2022

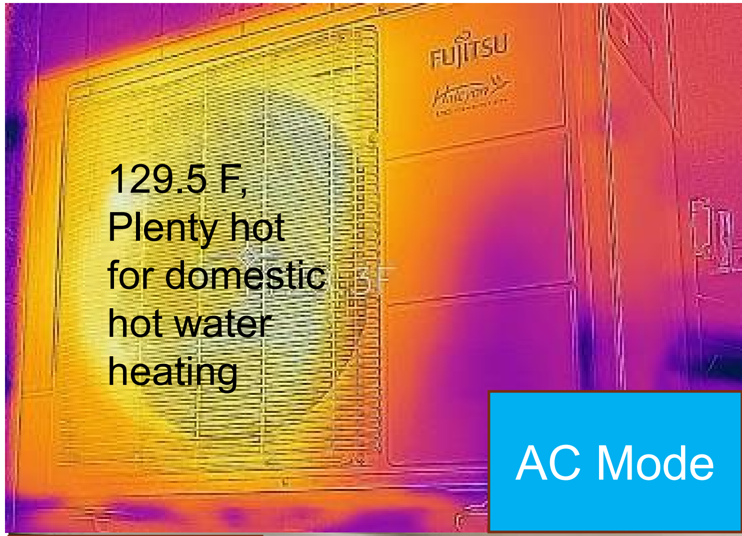
Edward Louie
Building Energy Efficiency Research Engineer
Pacific Northwest National Laboratory

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

Space Conditioning and Water Heating a Perfect Match for Integration

- Operating temps of a heat pump for space conditioning are the same as ideal temps for domestic water heating
- Outdoor unit of the heat pump for space conditioning can also be the heat pump for water heating
- Water tank(s) can allow space heating or cooling to be decoupled, to different degrees, from compressor energy use – useful for load shifting
- Water tank(s) can allow DHW to be decoupled, to different degrees, from compressor operation, such as allowing compressor to operate in cooling mode until DHW calls for heat



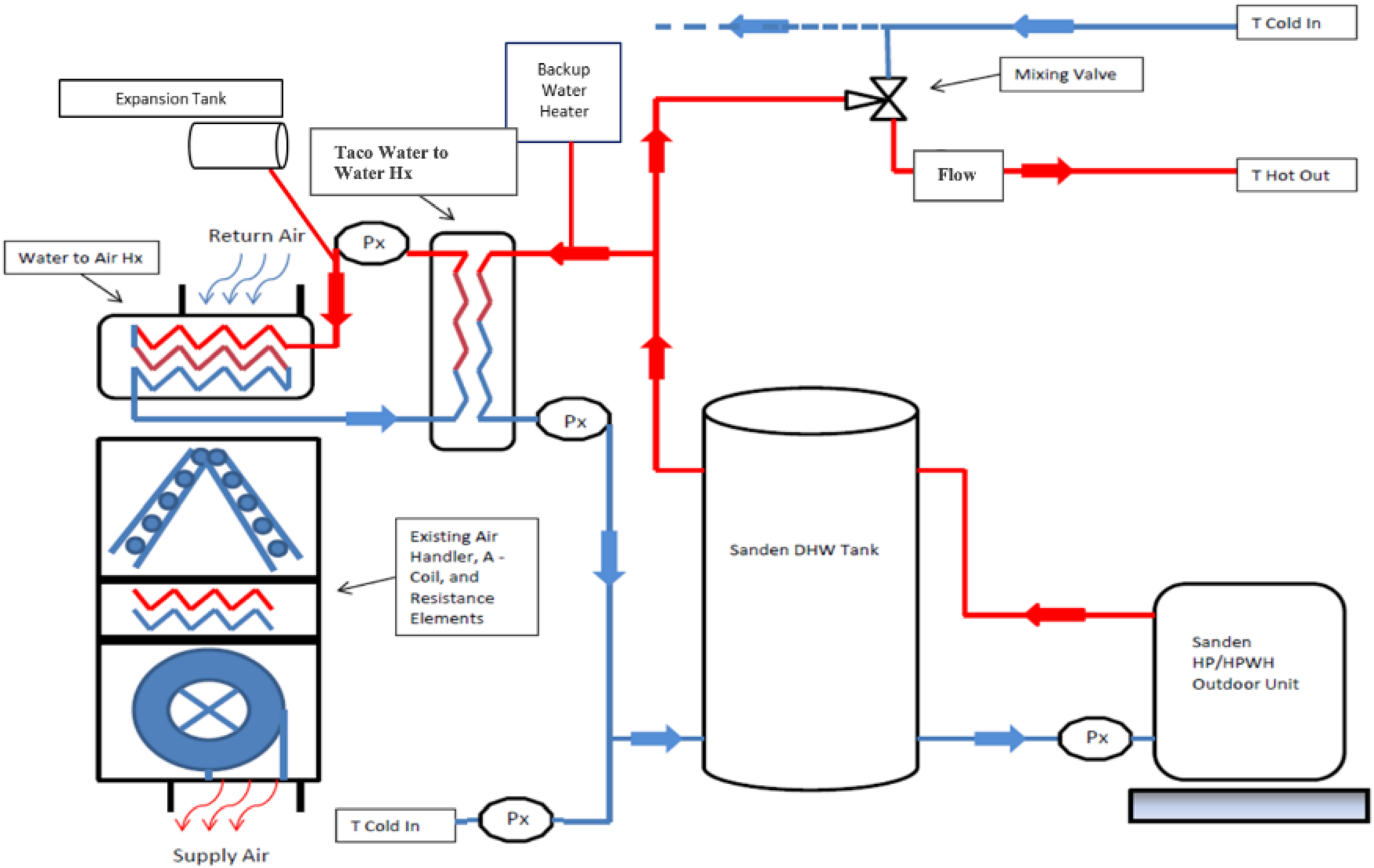
Multiple ways to do this

Outdoor Unit	Thermal Storage	Space Heating	Comments
Air-to-water	1 tank, direct exchange with tank	Water-to-air fan coil	No space cooling, more efficient but freezing risk, possible DHW comfort issues
Air-to-glycol	1 tank, DHW tank has internal heat exchanger	Water-to-air fan coil	No space cooling, glycol loop is less efficient
Air-to-glycol	2 tanks, direct exchange with buffer tank, DHW tank has internal heat exchanger	Water-to-air fan coil	Yes space cooling, takes more space for 2 tanks, glycol loop is less efficient
Air-to-glycol, simultaneous 4-pipe	1-2 tank, DHW tank has internal heat exchanger	Water-to-air fan coil	Yes space cooling, 4-pipe heat pumps expensive
Air-to-refrigerant	1 tank, tank with internal heat exchanger	Refrigerant-to-air fan coil	Yes space cooling

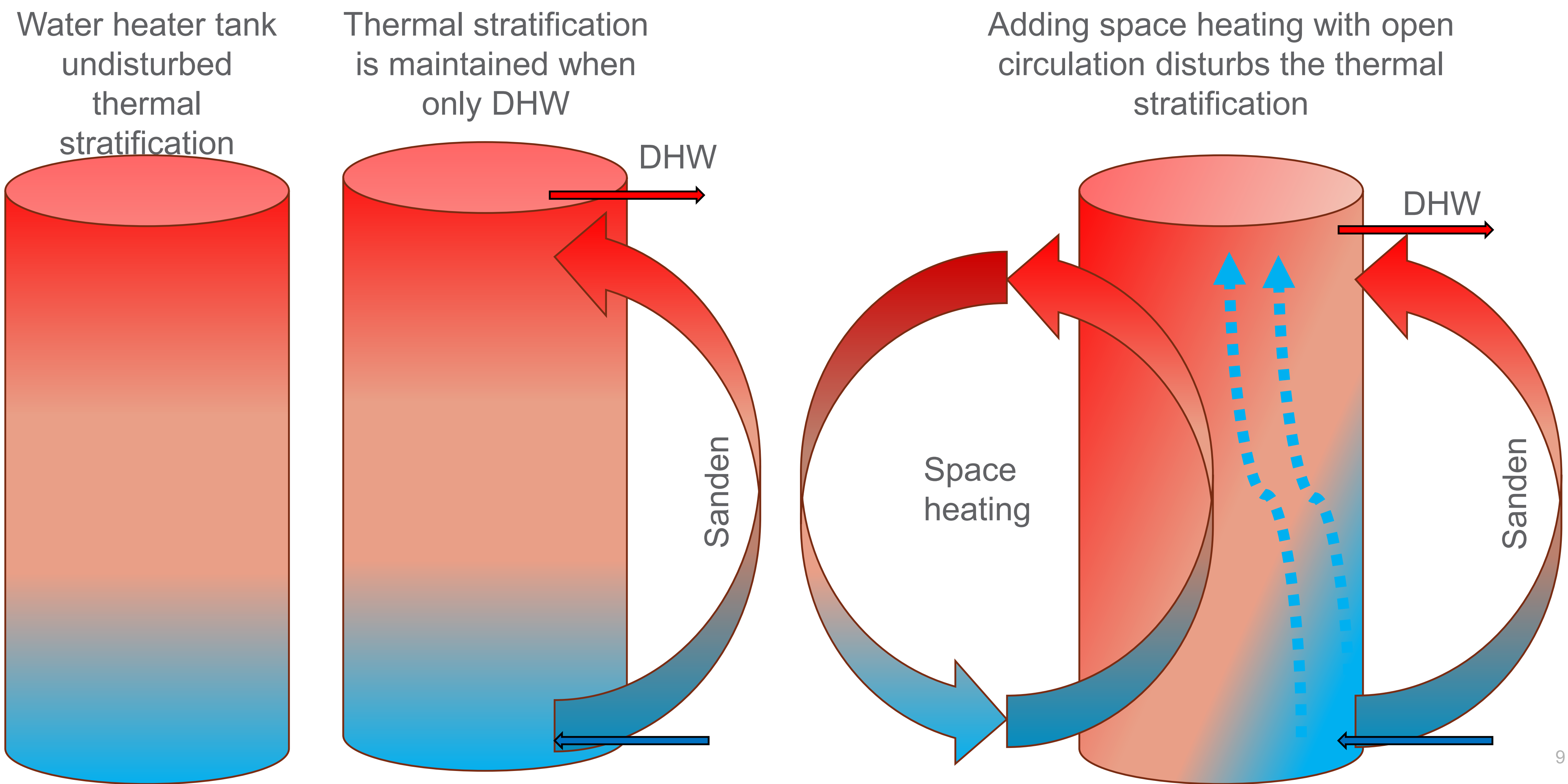
Air-to-water ODU, DX with Tank

Metzger, C. E., & Petersen, J. P. (2017). CO2 Combination Space Conditioning and Water Heating Stress Tests in the PNNL Lab Homes.

Important consideration: Potential to yield slugs of cold water in DHW when space heating is occurring

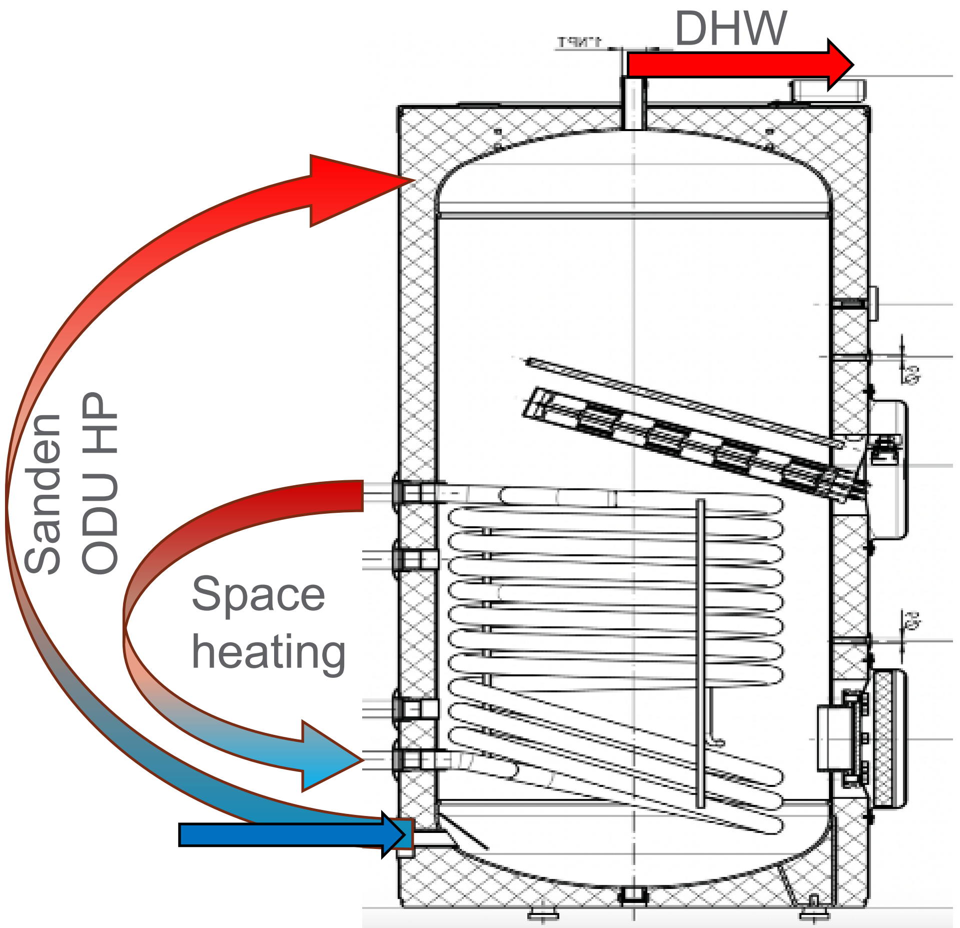


Thermodynamic Effects of Single Tank with Active Circulation



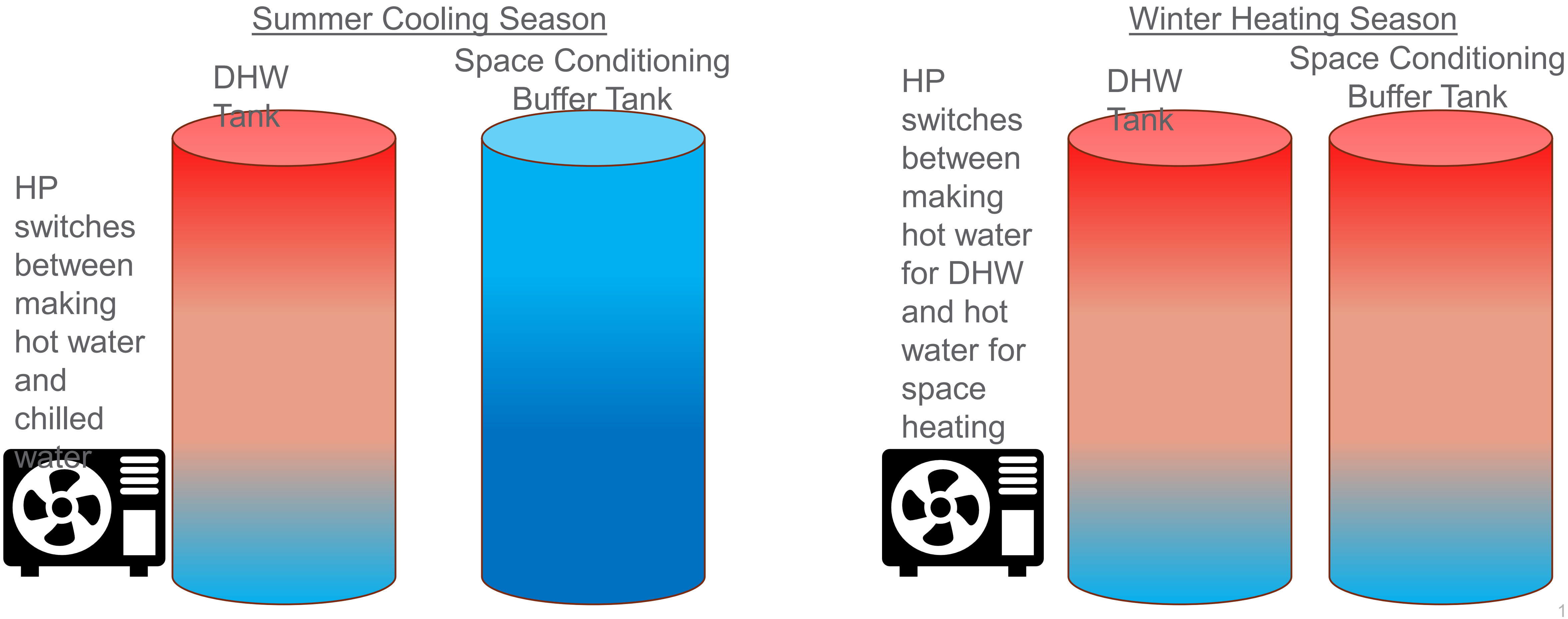
Thermodynamic Effects of Single Tank with One or Two Internal Heat Exchangers

Internal heat exchangers eliminate the circulation currents that can pull pockets of cold water from the bottom of the tank to the top



What if I want cooling also?

- With an air-to-water heat pump, two tanks are required to have cooling and DHW. Buffer tank connects to water to air fan coil units.



Antifreeze

- In cold climates, circulating antifreeze between the air-to-water heat pump and water tanks inside the tank is an effective precaution to mitigate the risk of damage to heat pump equipment from freezing due to a power outage.
- Circulating antifreeze requires the DHW water tank to have an internal heat exchanger and in some locations that internal heat exchanger needs to be double walled.
- Some areas allow single walled heat exchangers if propylene glycol is used.

Example Systems

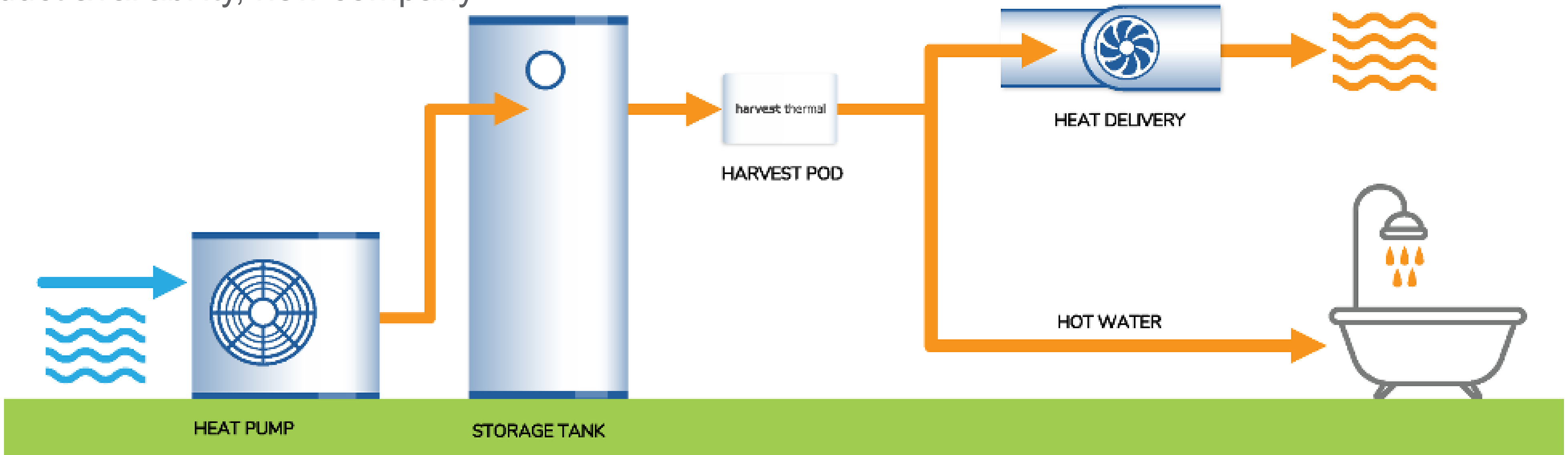
harvest thermal

Pros:

- No field made refrigerant connections, air-to-water heat pump
- This system detects with a flow sensor when large DHW water draws occur to prioritize using a 3-way valve hot water for DHW with the idea that space thermal comfort won't noticeably be affected if reduced for 10 to 30mins, the time it takes for a shower. Potentially solves the intermittent slugs of cold-water problem from using one tank

Cons:

- No cooling
- Limited product availability, new company



Example System

Pros: Air-to-water heat pump, two tank system, DHW tank and hot or cold-water buffer tank feeding one or multiple slim fan coil heads (no duct losses).
Cons: Conditioning of the two tanks not simultaneous, lots of plumbing, limited product availability, new company

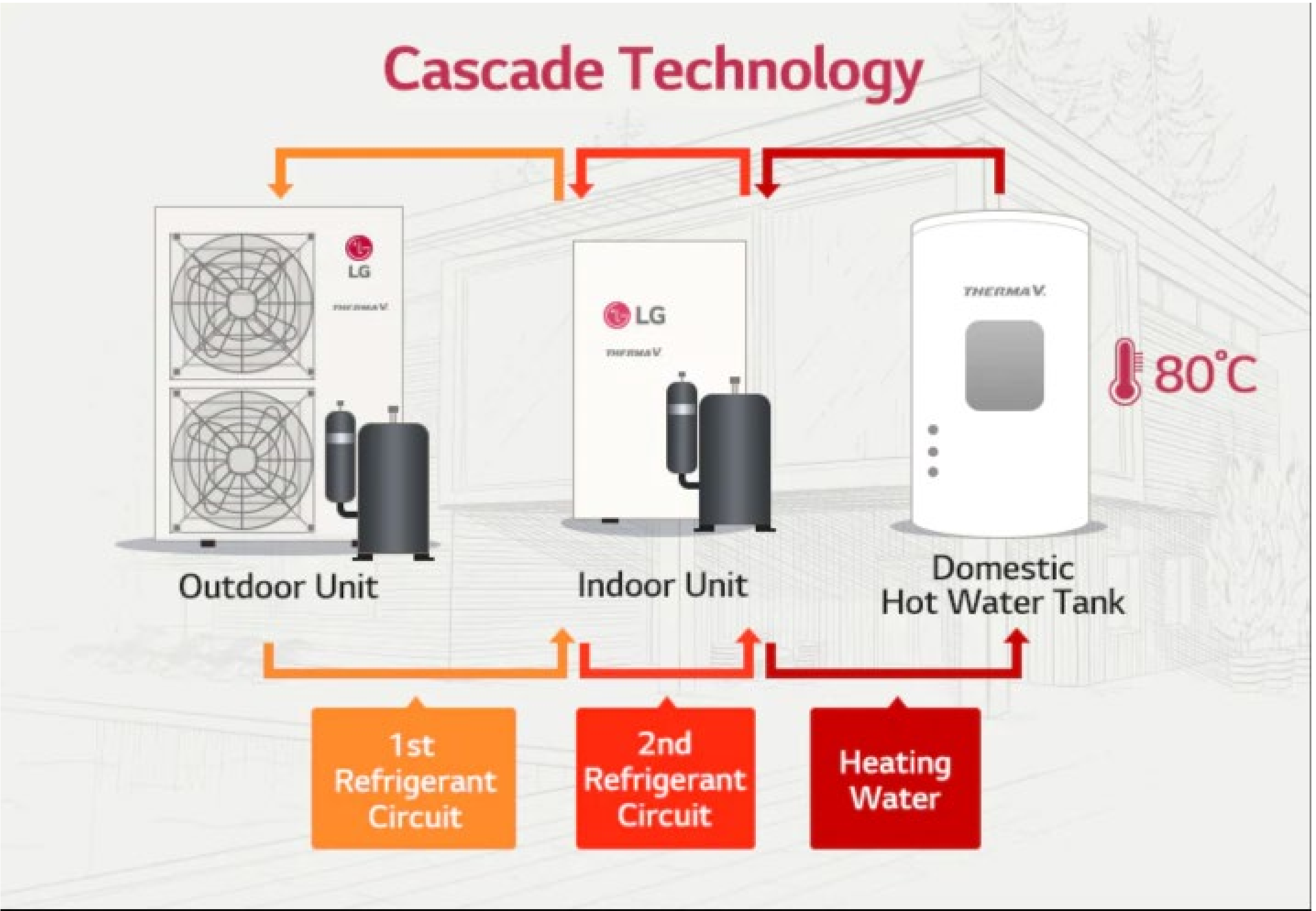
Air to glycol heat pump

Two tanks
1. DHW tank with internal HX
2. Space conditioning thermal buffer tank

Zoned or central glycol to air fan coil units

Cascade for Hotter Water

Example LG Therma V Cascade



4-pipe Heat Pump

Pros:

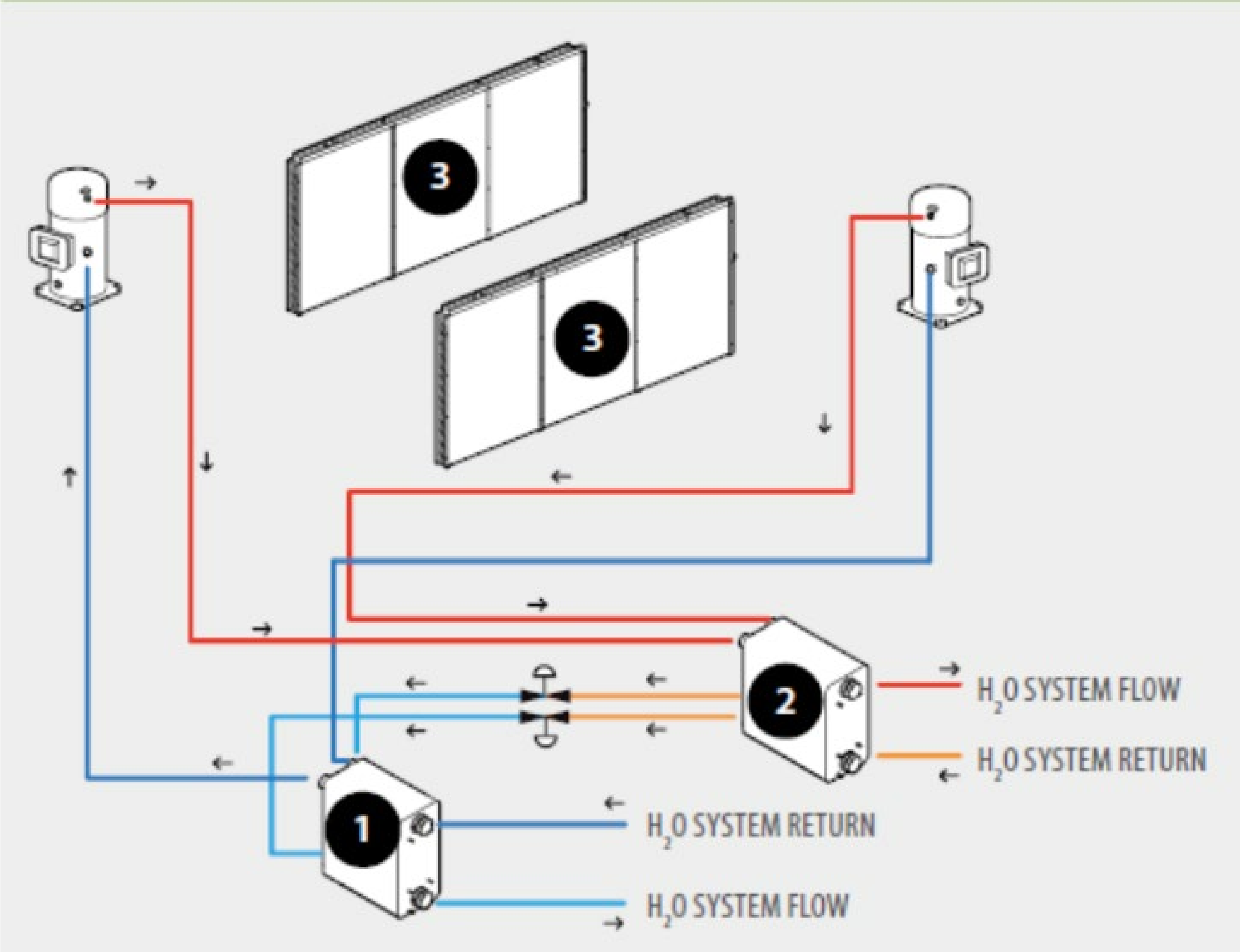
- Heat recovery
- Extremely energy efficient when near balanced heating and cooling load

Cons:

- Expensive
- Need freeze protection
- No residential sized equipment

Brands:

- Aermec NRP
- Mitsubishi Climaveneta INTEGRA
- Hidros
- Clivet ELFOEnergy Magnum
- FläktGroup HeaMo
- Motivairc



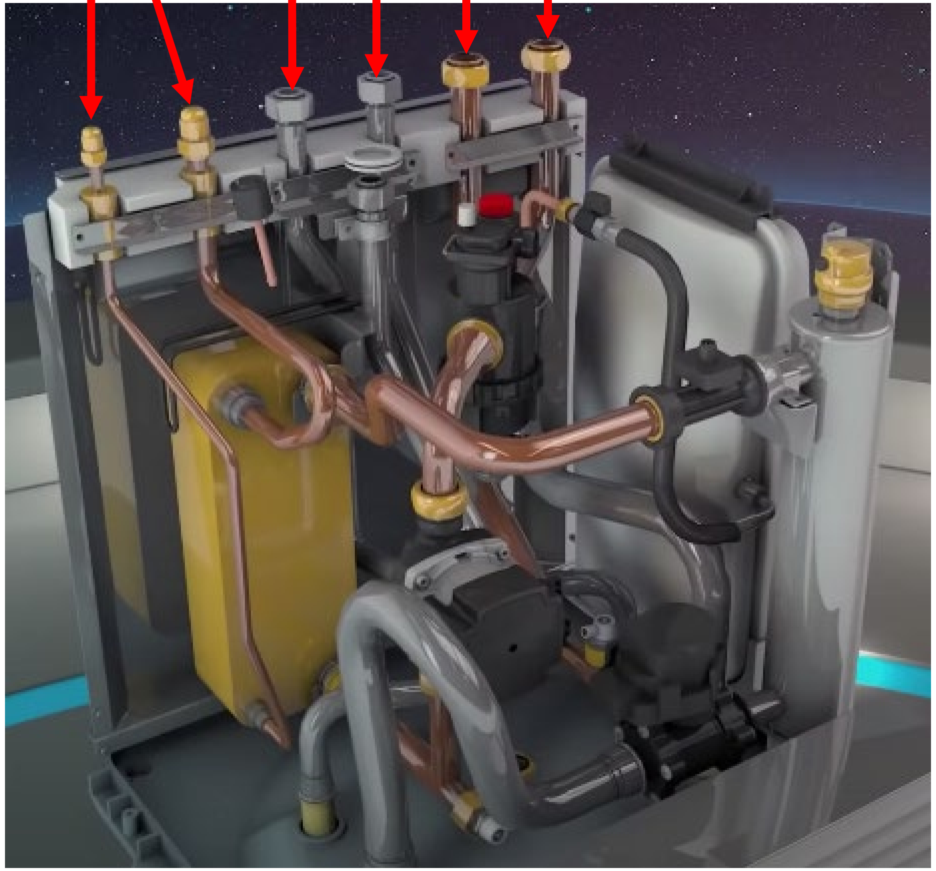
VRF Heat Pump Without Heat Recovery

Pros:

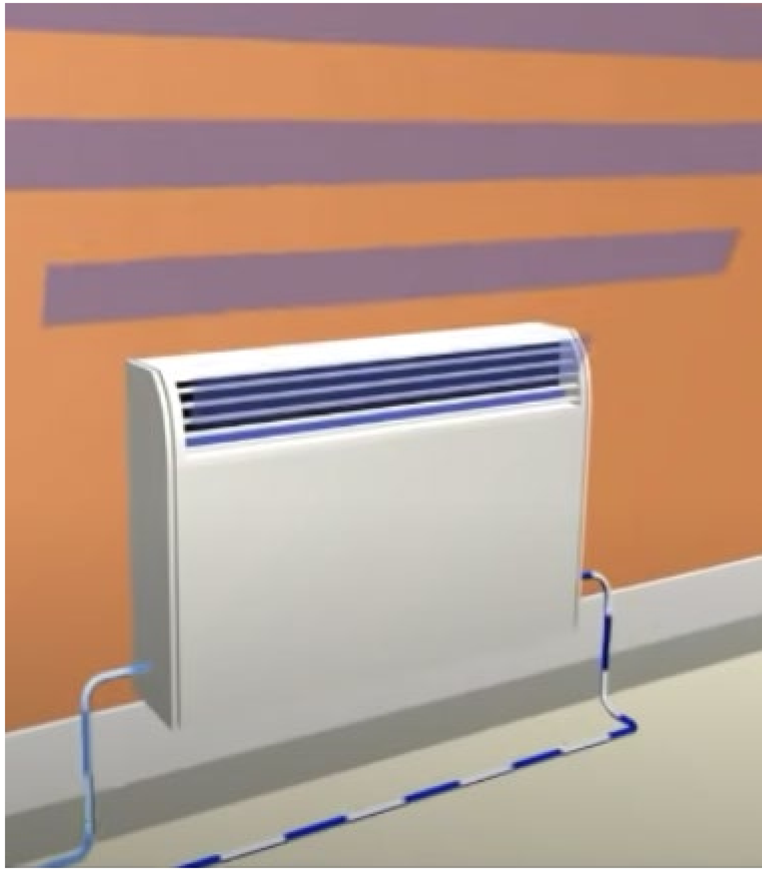
- Lower cost than with heat recovery
- Space heating decoupled from heat pump operation

Cons:

- Limited product availability in the U.S.
- Cooling not simultaneous with DHW heating
- No decoupling of space cooling from heat pump operation
- Cooling less efficient
- Refrigerant connections made in the field



Example hydronic fan coil



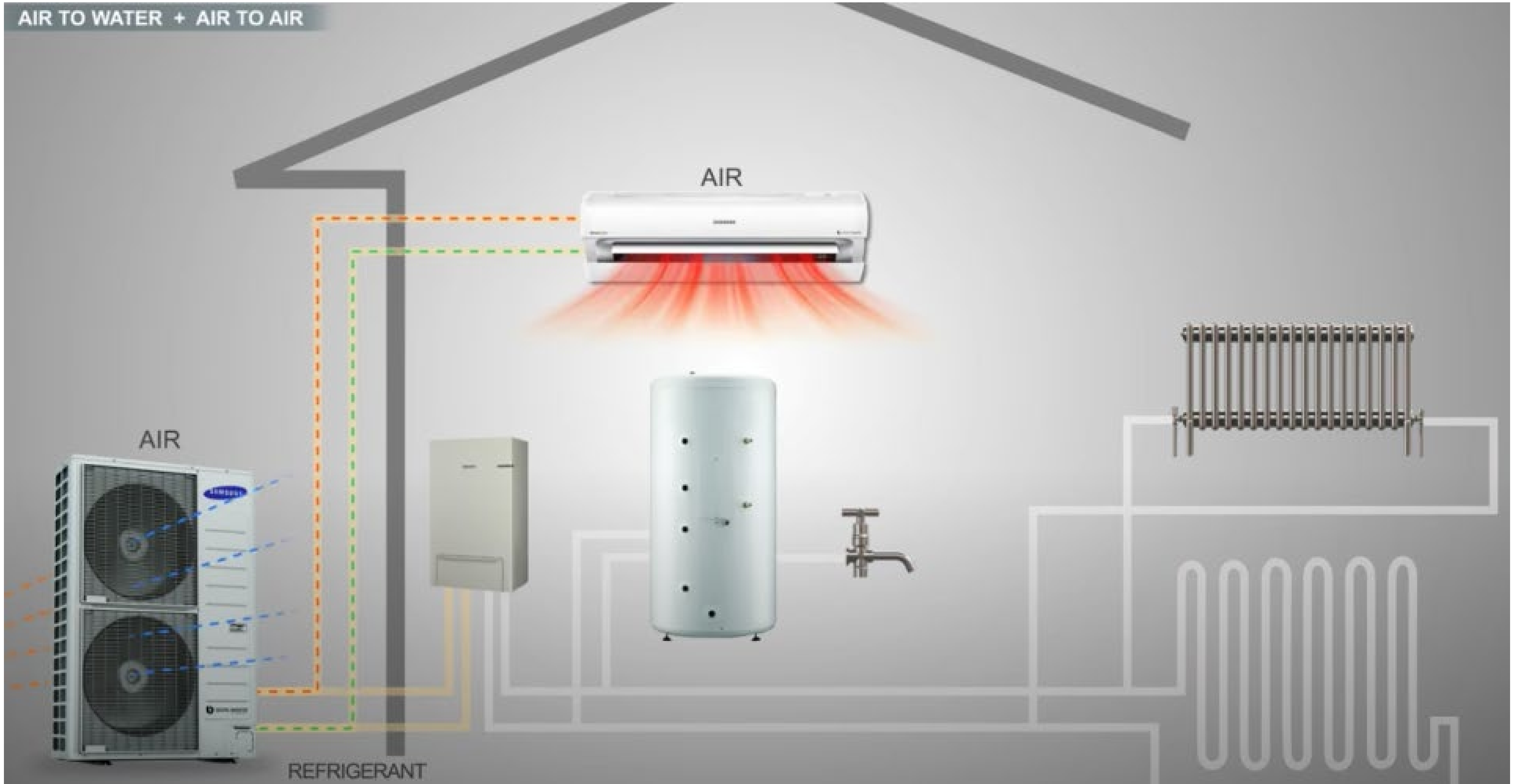
Example: Daikin Altherma 3, and LG Therma V Split

VRF Heat Pump Without Heat Recovery

Samsung Eco Heating Systems; Mitsubishi Ecodan

Similar system as previous slide but air handler(s) are connected on the refrigerant side

Cooling <u>not</u> simultaneous with DHW heating



VRF Heat Pump With Heat Recovery

Pros:

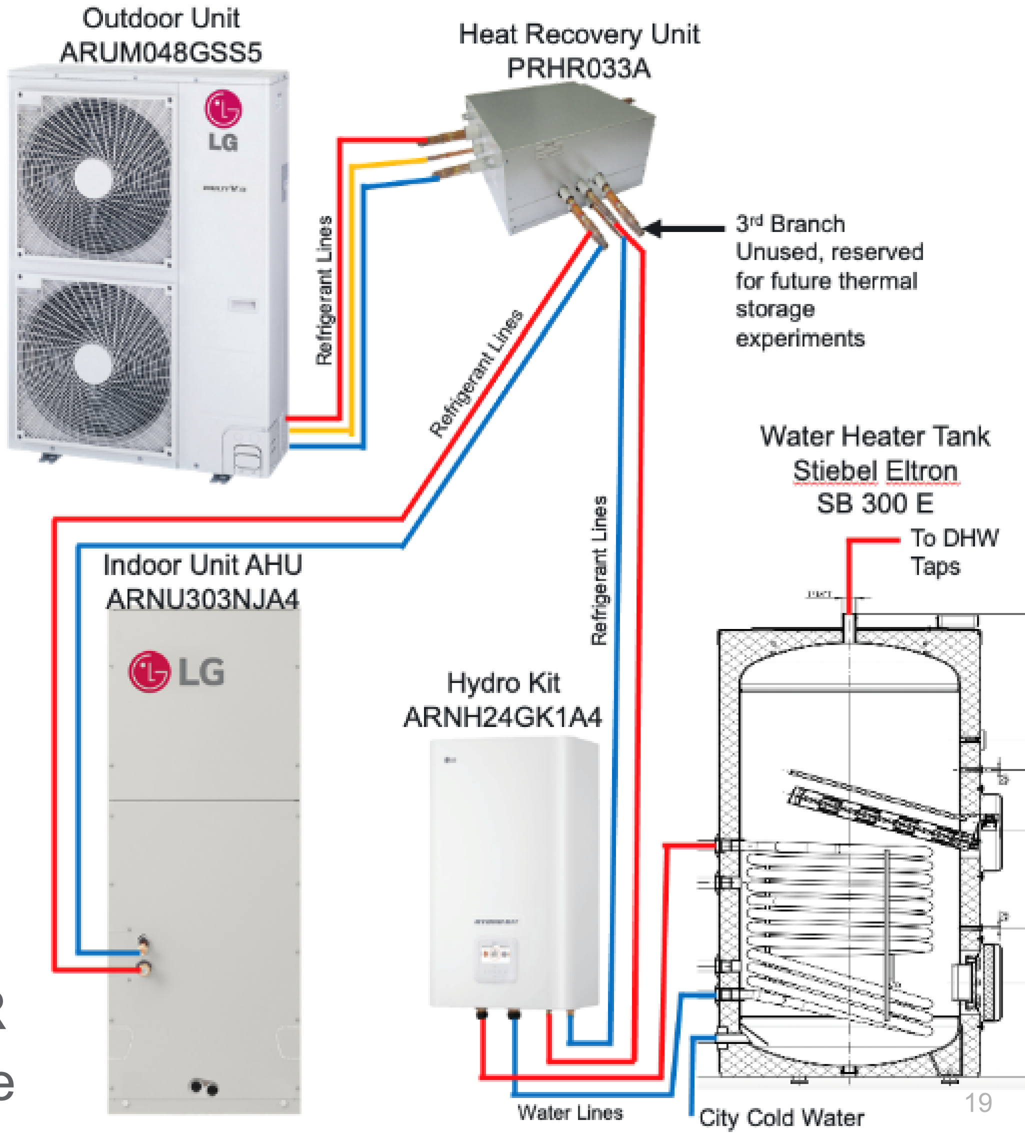
- Cooling available without needing a second water tank
- No risk of freeze damage during power outage
- Heat recovery, AC waste heat used to heat water if it occurs simultaneously
- Mature technology in the commercial space

Cons:

- Refrigerant connections made in the field
- All operations likely require some use of the compressor
- Heat recovery adds cost

Brands:

- Currently only limited brands in the residential size space: LG Multi V S. and Samsung DVM S Eco HR
- Lots of brands in the commercial system size space



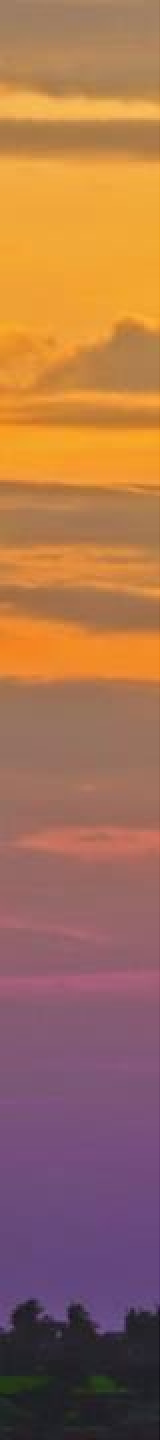
Conclusion: Pros and Cons of Integrating Space Conditioning and DHW

Pros

- Fast heating of domestic hot water even at temperatures below 45 F due to the heat pump being much larger than packaged HPWHs
- DHW tank flexibility, tank can be shorter, smaller, or placed in a location where there is no air volume, or where thermal fluctuations or noise would be unacceptable
- Optimal use of the hardware and inertia of the building and water tank

Cons

- Systems that can do this are either not yet available in the U.S. market, or are new companies, or are expensive systems that have yet to prove their energy savings are worth the higher cost
- Still room for manufacturers to streamline and cost optimize their products for integrated space conditioning and DHW



Thank you

Edward.louie@pnnl.gov

Dana Fischer

Mitsubishi Electric US, Inc – Heating & Cooling

100 years of INNOVATION

MITSUBISHI ELECTRIC TRANE

MITSUBISHI ELECTRIC TRANE HVAC US

Heat Pump Furnace and Water Heater in one?

Not a question of how.

Dana Fischer

Director, Regulatory Strategy

[redacted]

Market Trends | Sustainability Mega-Trend

Environmental Sustainability:
Reduce direct and indirect greenhouse gas emissions by 15-18% by 2030, reduce CO_2 emissions to net-zero by 2050

Gigaton Challenge:
Reduce customer carbon footprint by 1 gigaton of CO_2 through HVAC and transport refrigeration products and services

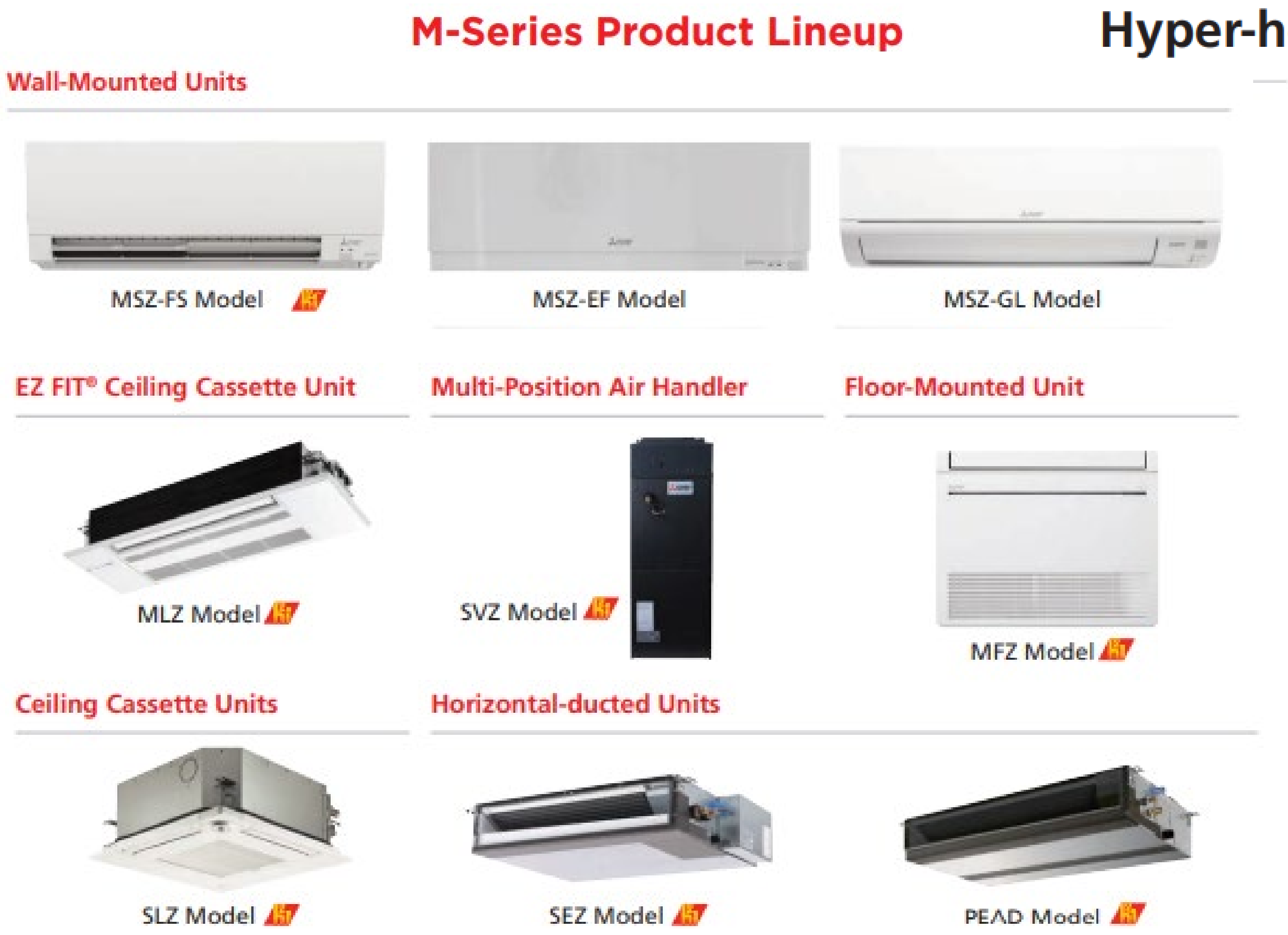
Portland ME, Jan 11th, 2022
(2) FS12 systems
1,500 sq ft heated space.

Total operational usage:
422 kWh November
829 kWh December
1,421 kWh January (v. cold)

All heat pump heat

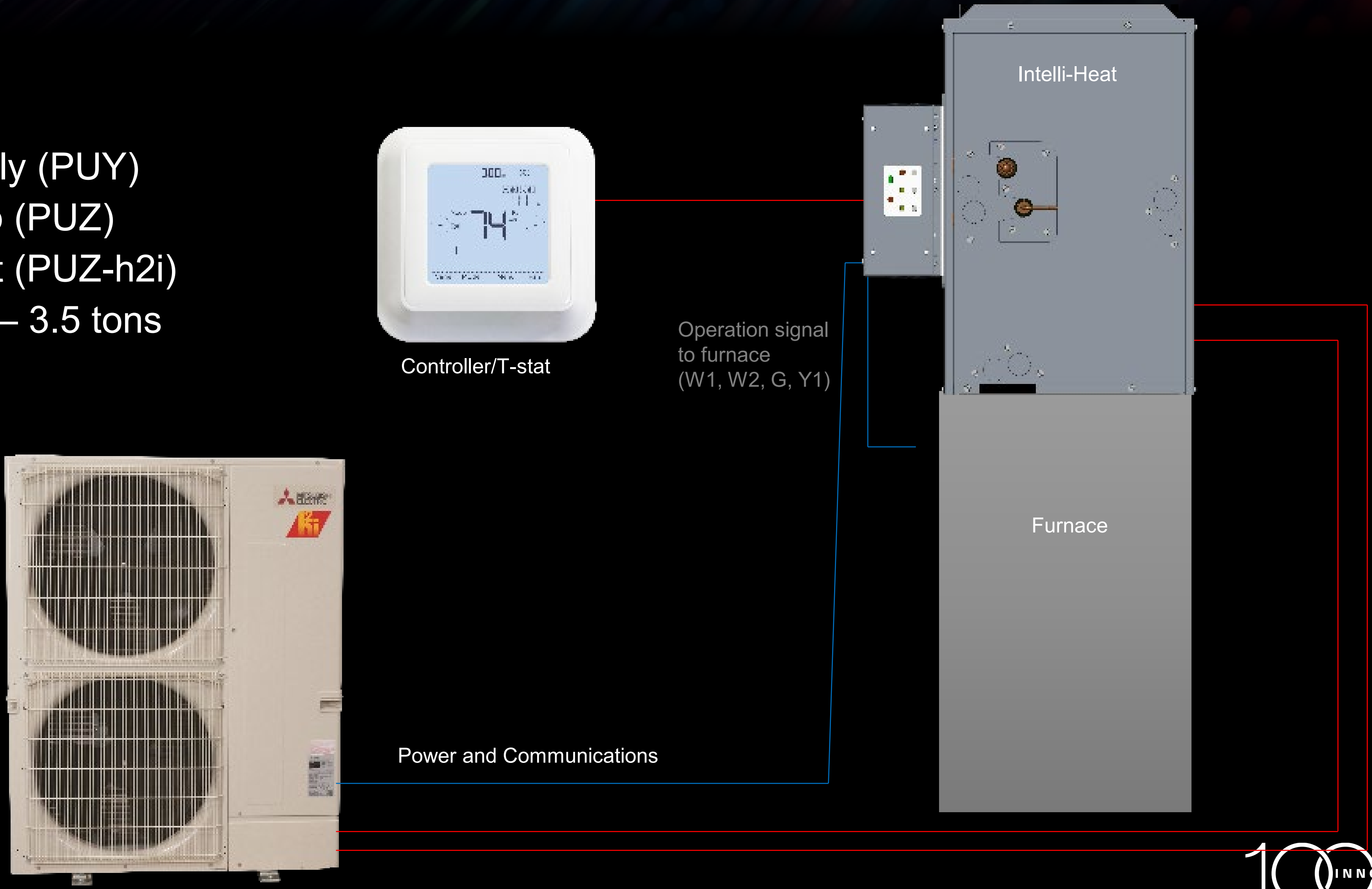
Indoor Units for varied uses and distribution (in US)

Hyper-heating



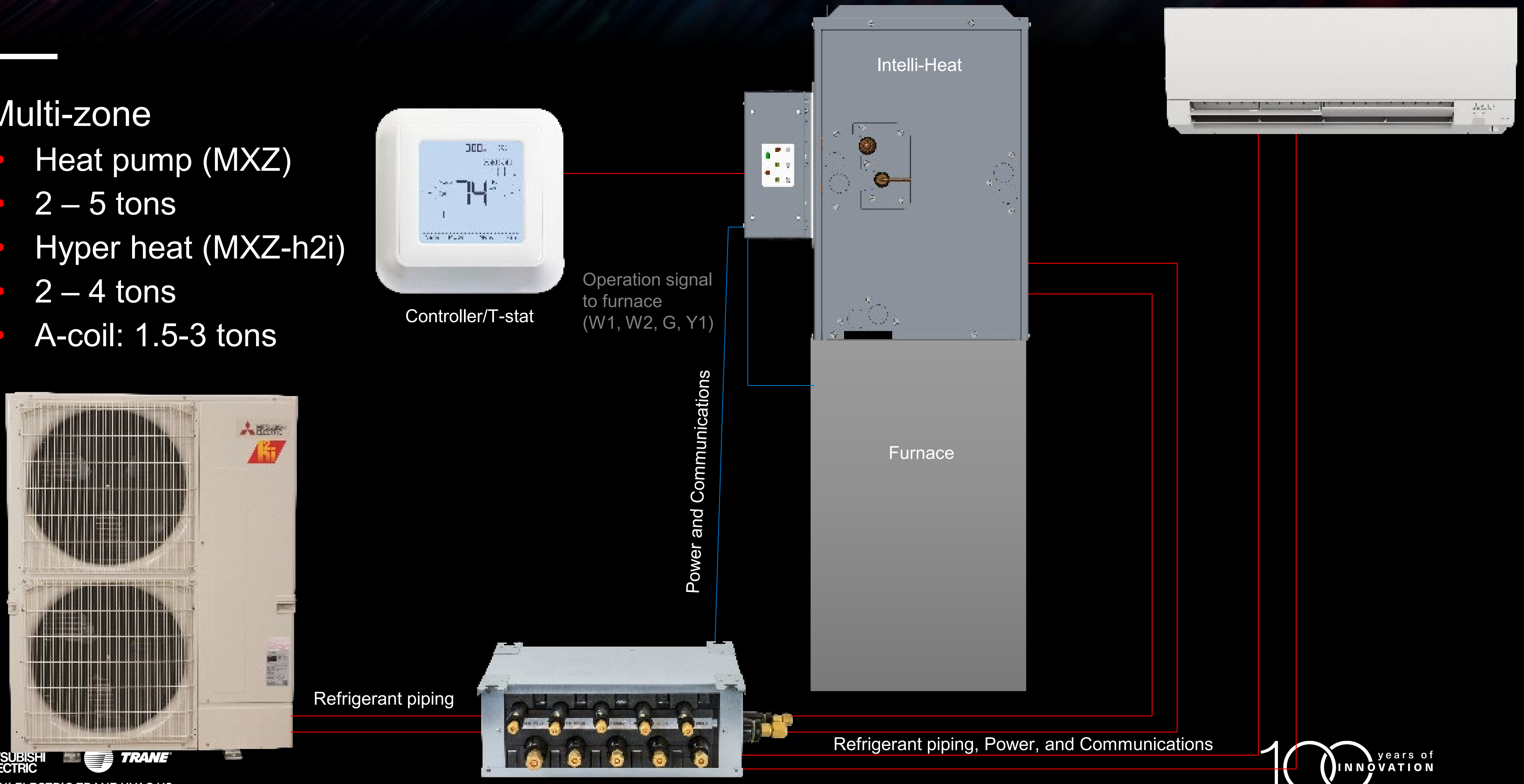
Intelli-Heat Dual Fuel System (A-coil) | Single-zone System Layout

- Single zone
  - Cooling only (PUY)
  - Heat pump (PUZ)
  - Hyper heat (PUZ-h2i)
  - A-coil: 1.5 – 3.5 tons



Intelli-Heat Dual Fuel System (A-coil) | Multi-zone System Layout

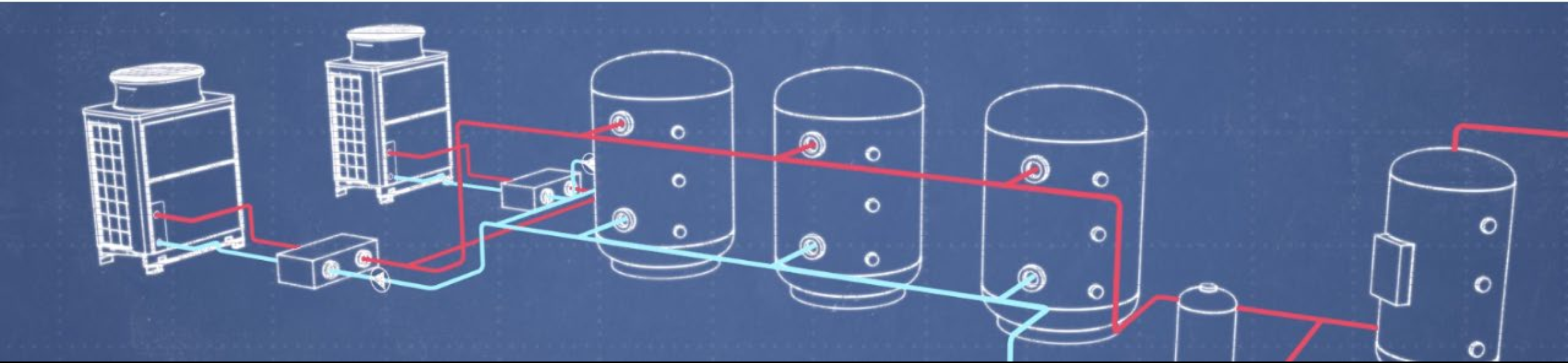
- Multi-zone
  - Heat pump (MXZ)
  - 2 – 5 tons
  - Hyper heat (MXZ-h2i)
  - 2 – 4 tons
  - A-coil: 1.5-3 tons



Commercial CO2 Domestic Water Heater “The QAHV”
133 kbtu/hr per module 176F outlet temperature

HEAT₂O™

Introducing an all-electric, domestic hot water heating system.



CO2 and R32 water heating systems available in Europe, & Asia.

Versions headed this way…

QUHZ-W40VA

Ecodan R744

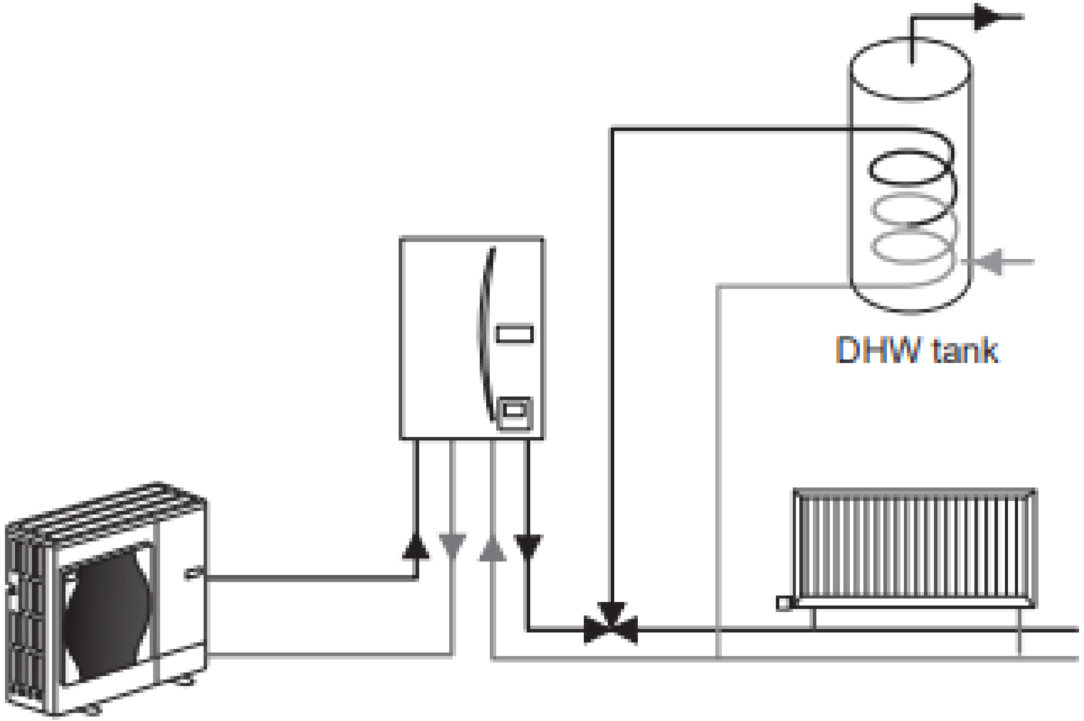
Monobloc Air Source Heat Pump

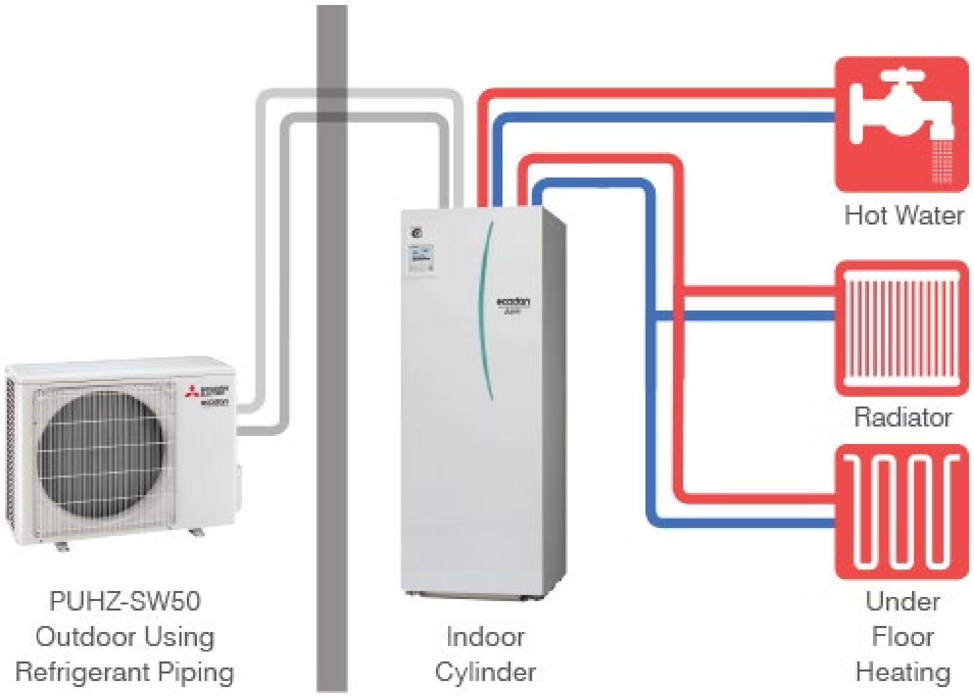
R744

Key Features:	Key Benefits:
Compact design	Minimal installation space required
Low noise levels	Flexible product placement
Boiler replacement ready	Suitable for both new and existing homes
Zero carbon solution	Help to tackle the climate crisis
MELCloud Enabled	Remote control, monitoring, maintenance and technical support

MELCloud

MCS





PUHZ-SW50
Outdoor Using
Refrigerant Piping

Indoor
Cylinder

SW50
5.0kW, 200L

SHW80
8.0kW, 200L

SHW112
11.2kW, 200L

SW120
12.0kW, 200L

SHW80
8.0kW, 300L

Can you have it all?

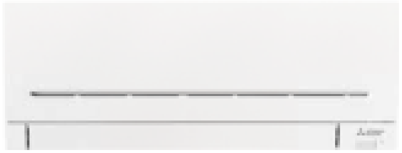
What are the Key Components?

The Outdoor Unit

The outdoor unit uses electricity to absorb freely available heat energy from the surrounding air and then transfers it to your home so it can provide energy efficient hot water heating, radiator and underfloor heating, as well as space heating or cooling.

The Branch Box

The outdoor unit is connected to a specially designed branch box. This branch box is the technological heart of the Mitsubishi Electric Multi Room with Hot Water System. It intelligently draws energy from the outdoor unit and directs the flow of energy through its individual branch ports to the different connected indoor components.



The Indoor Air Conditioning Units

Just like a traditional multi room combination any indoor model from the Mitsubishi Electric Multi Room Range can be connected to the system. This includes high walls, floor consoles, ceiling mounted and even ducted concealed styles. The Multi Room System can heat or cool multiple areas with individual temperature control for each room. This means you can adjust the temperature to suit your comfort levels and ensure individual rooms are only operating when needed, maximising energy efficiencies.*

The Ecodan Hot Water System

Either an all-in-one Mitsubishi Electric Ecodan Packaged Hot Water Cylinder System or Mitsubishi Electric Ecodan Hydrobox with a 3rd Party Cylinder, can be connected to the branch box to satisfy the hot water requirements.

Designed with flexibility in mind, the system allows for various configurations to suit different applications. It can include potable hot water, underfloor and radiator heating throughout the whole home.

The Optional Lossnay Energy Recovery Unit

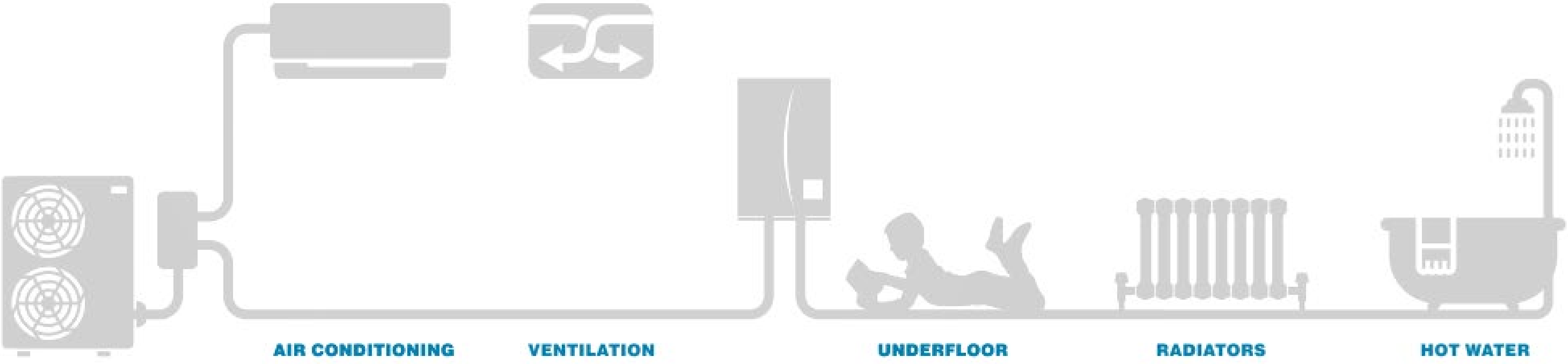
The Lossnay Heat Exchanger Core recovers energy from the extracted stale air, to pre-warm or pre-cool the incoming Fresh air.

*Note: The Multi Room Range is not simultaneous heating and cooling.

Multiple options for providing domestic hot water in addition to configuration with any style of indoor unit.

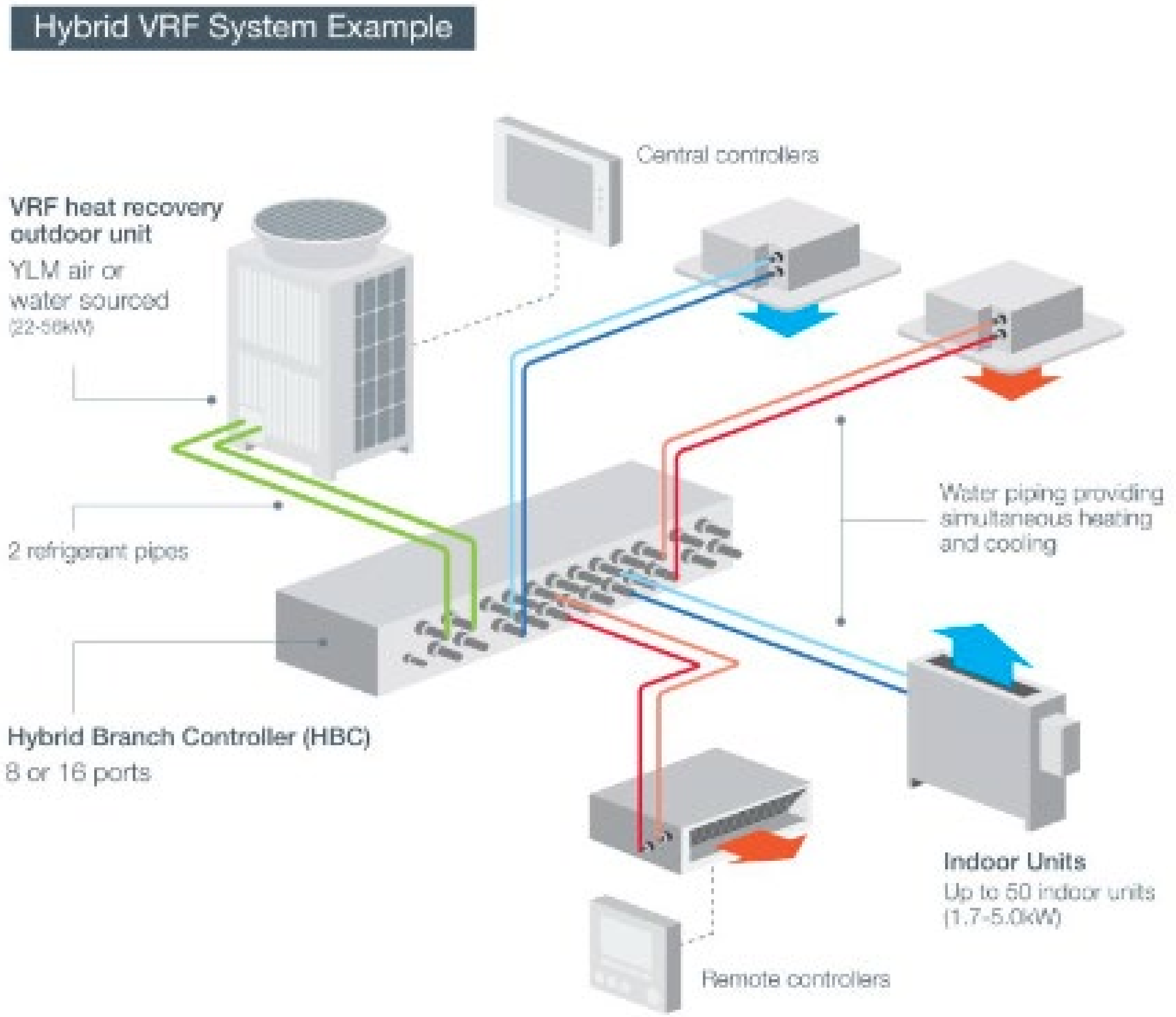
Ecodan Hydrobox

Ecodan Cylinder



It’s time to talk
Hybrid VRF

Part of the transition to new refrigerants will be the arrival of hybrid VRF systems that limit refrigerant to the circuit between the outdoor unit and a heat exchange branch controller. The balance of the system is circulating heated or chilled water.



Hybrid Branch Controller (HBC)

At the heart of Hybrid VRF

Image for representation only

A. Plate Heat Exchangers

This is the point where the refrigerant circuit transfers its energy to the sealed water system.

There are two sets of plate heat exchangers, both placed at opposite ends in the HBC box.

Both sets provide hot water in heating mode or cold water in cooling mode.

During mixed mode, one set provides hot water while the other provides cold water to it's respective flow header.

B. Pumps

Each set of plate heat exchangers has a DC inverter driven water pump.

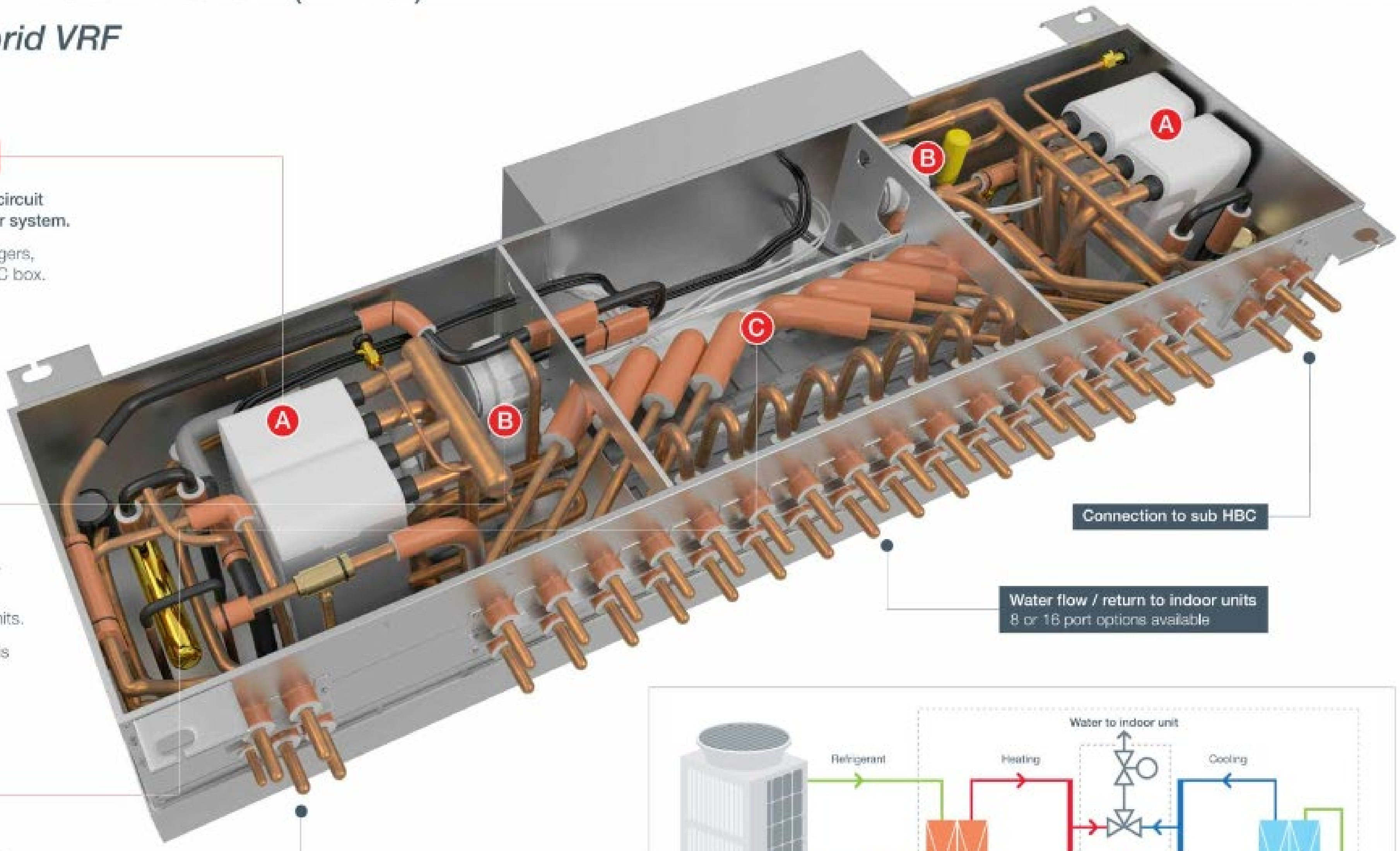
This circulates the closed loop water system between the HBC and indoor units.

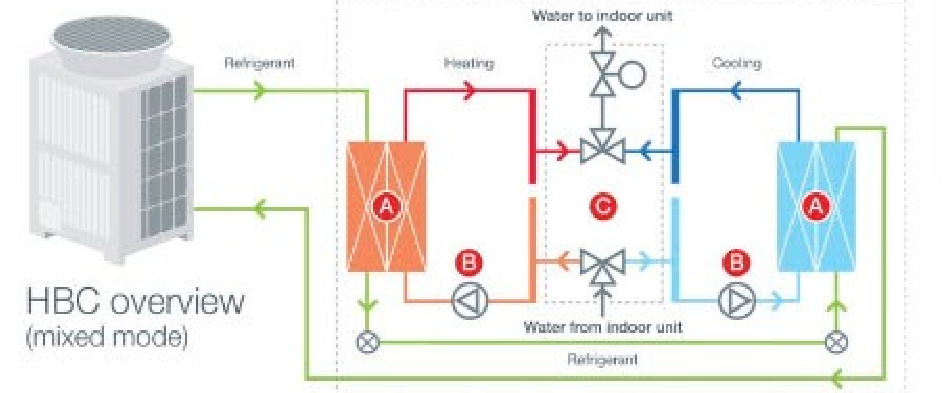
The discharge flow rate from the pump is controlled by the valve block.

C. Valve Block

A valve block is connected between each flow and return port of the HBC.

This valve block has two features; firstly it has the choice of selecting between the two flow headers and secondly it controls the flow of the water sent to the indoor unit, defining the capacity.



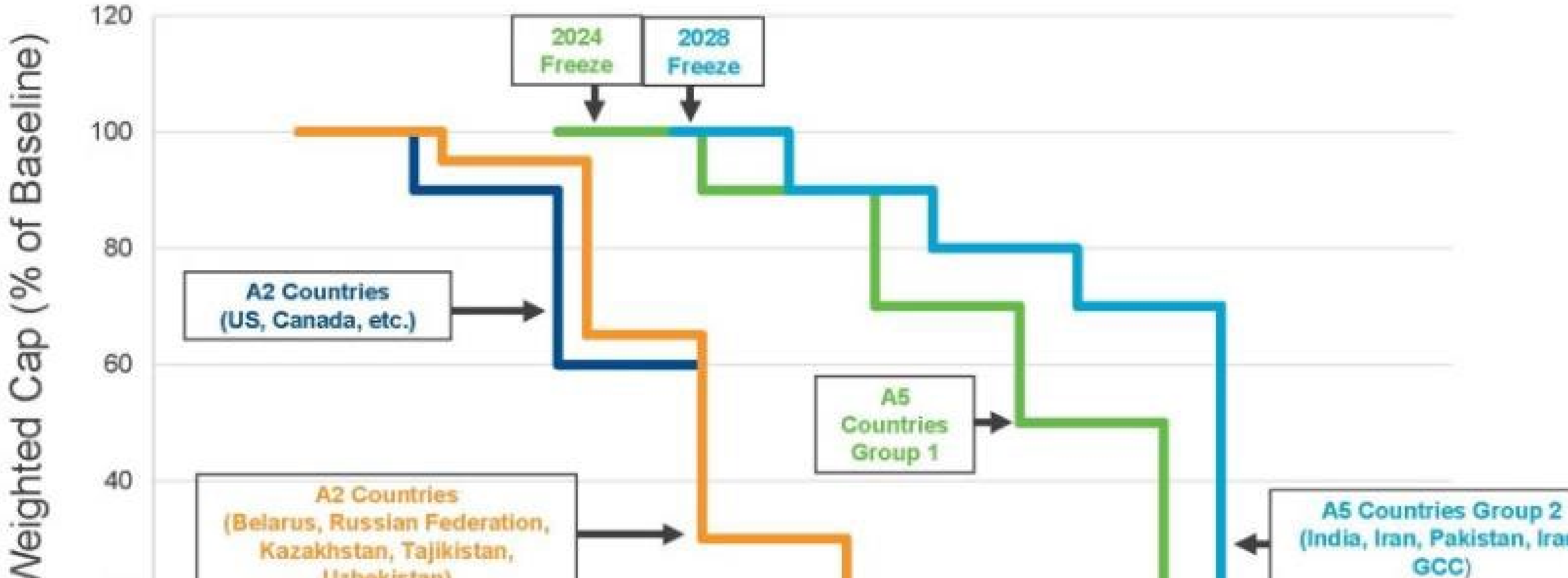


HBC overview
(mixed mode)

How Soon?

Market factors determine arrival.

- Assessment of demand
- Standards, ratings, incentives
- Supply chain constraints
- Refrigerant transition



100 years of INNOVATION

MITSUBISHI ELECTRIC TRANE HVAC US

Thank you!

Geoff Wickes

Northwest Energy Efficiency Alliance

U.S. DEPARTMENT OF ENERGY

Combination Space and Water Heating Systems Overview of Electric and Gas

October 27th, 2022

Geoff Wickes Senior Product Manager at NEEA

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Noe Contreras, Senior Product Manager Gas at NEEA,

ncontreras@neea.org

(Combo – "o" for Ohms or electricity)   Combi "I" for ignition in gas

A tribute to Ken Eklund Washington State Energy Office
and the Eco Runo
1949-2018

NW Projects on Advanced Heat Pump

- BPA Funded Projects (NEEA provided metering, monitoring and installation maintenance)
  - TIP 292 Performance as a Water Heater
    2012-2016
  - TIP 302 Demand/Response Potential of Split and Unitary Systems
    2013-2015
  - TIP 326 Combined Space and Water Heating in New, High Efficiency Homes
    2014-2016
  - TIP 338 Combined Space and Water Heating in Existing Homes
    2015-2018

- NEEA Co-Funded Project EcoRuno CO_2 HPWH used for Space and Water Heating 2016-2019

BONNEVILLE POWER ADMINISTRATION

Energy Program WASHINGTON STATE UNIVERSITY

neea

CO2 Heat Pump Technology

- Split System
- CO_2 Refrigerant - GWP = 1
- Variable Speed Inverter Driven
- No Electric Element
- 158F output Temp (single pass)
- Excellent low ambient performance

Sanden Eco Runo
27kBtuh
Dedicated space heater

Sanden (GAU unit)
15kBtuh
Dedicated water heater

Example System (Tacoma)

Before	After
	 

Heat Pump COP and System Field Efficiency Factor (EFF)

- COPs measuring performance are very good at all homes HZ1
  - Daily average Combi-Mode COP ranged from 2-6
  - Daily average DHW-Mode COP ranged from 3-5
- FEF values, which account for system losses, were significantly lower
  - We are not sure why this is – this is still under investigation

Site	System Type	FEF				COP			
		Annual		Median Daily		Annual		Median Daily	
		Combi	DHW	Combi	DHW	Combi	DHW	Combi	DHW
McCall-1	RS	1.14		1.15	*0.04*	2.72		2.79	*1.88*
McCall-2	RS	1.72		1.75		3.04		3.16	
Portland-1	RS					*4.46*	*4.44*	4.54	4.44
Portland-2	FAF	2.20	1.34	2.16	1.29	*3.62*	*3.17*	*3.63*	*3.09*
Salem	RHZ	*2.03*	0.89	*1.79*	0.92	3.04	3.65	3.46	3.93
Montana	RS	*1.31*	*1.24*	*1.28*	*1.23*	*2.03*	*1.67*	*1.93*	*1.71*
Tacoma	FAF	*2.37*	*1.58*	2.40	1.67	*3.20*	*3.47*	3.36	3.63

Annual Energy Use (kWh)

	System Type	Annual Heat Transfer to Main Glycol Loop (Q_{eco})	Auxiliary Hot Water Heating	Annual Space Heating Load (Q_{supply})	Annual Domestic Hot Water Heating Load (Q_{dhw})	Calculated Losses	
						kWh/yr	%
		kWh/year	kWh/year	kWh/year	kWh/year		
McCall-2	RS	17,186	13	9,724	409	7,067	41%
Portland-2	FAF	*20,217*	0	10,724	2,322	7,171	*35% estimated*
Salem	Hydronic Baseboard	31,256	0	*19,770*	1,464	11,448	*35%*
Montana	Hydronic Zoned	*7,562*	-	2,598	*2,284*	2,680	*35% estimated*
Tacoma (totals over 7 months)	FAF	6,001	0	1,921	2,122	1,957	34%

Italics indicates remediated data – data adjusted

Big Parasitic Losses

- Parasitic Losses
  - ~35% of total load occupied homes
  - More than just storage tank losses - lots of piping, pumping and circulation of warm fluids
- Interior Piping Not Always Insulated
  - Sites with piping insulation were in garages
    - Tacoma
    - Portland-2
  - Salem system installed in a closet with an exterior wall
  - Portland-1 system installed in unconditioned basement

Salem house equipment room

Lessons Learned*

- Overall
  - EcoRuno system appears to operate well as a space heater when the load is significant
  - Combi complexity does not appear to provide additional performance or cost savings
  - Lack of cooling limits applicability of Combi system

- Performance
  - CO_2 HPWH is better suited for sites with high heating needs
    - Heating load should be large relative to standby losses
    - COP declined significantly with unit heat outputs less than 10-20 kWh/day.
    - Homes with low heating requirements were not good candidates:
  - Storage tank and circulation loop standby losses are significant
  - Standby losses increased with uninsulated pipes – weatherize pipes

*Preliminary Findings – final report due Q2 – 2023

Taco Combination Heat Pump

Heat Pump Unit
(67 in. Height)

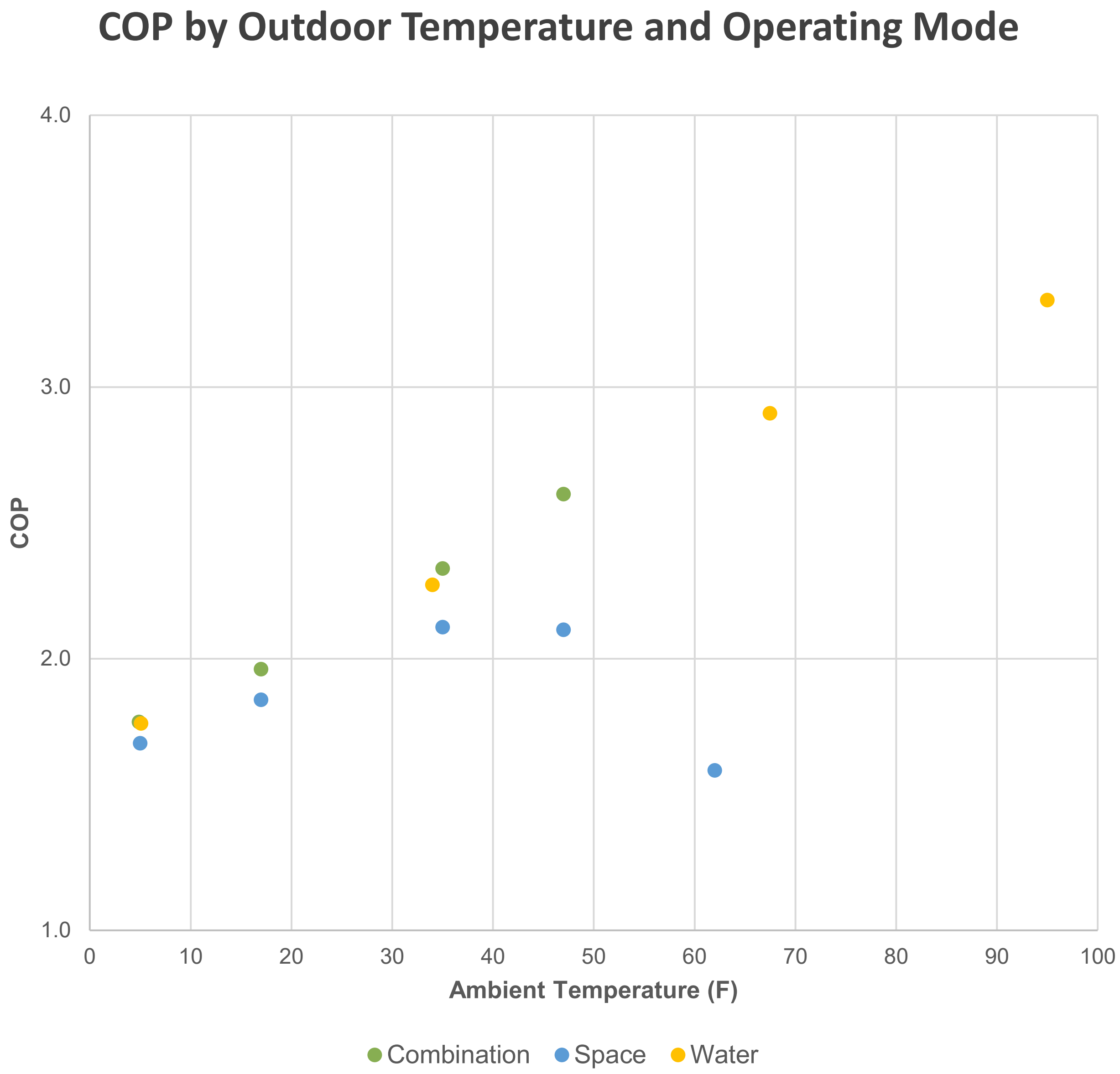
85-gal Tank
(62 in. Height)

HydroBox
(66 in. Height)

HydroBox
Internal Plumbing

Lab Testing Results

Heat Pump Unit
in Thermal Chamber



Equipment now installed in a home in Portland, OR.
Field monitoring in progress.

Additional Thoughts

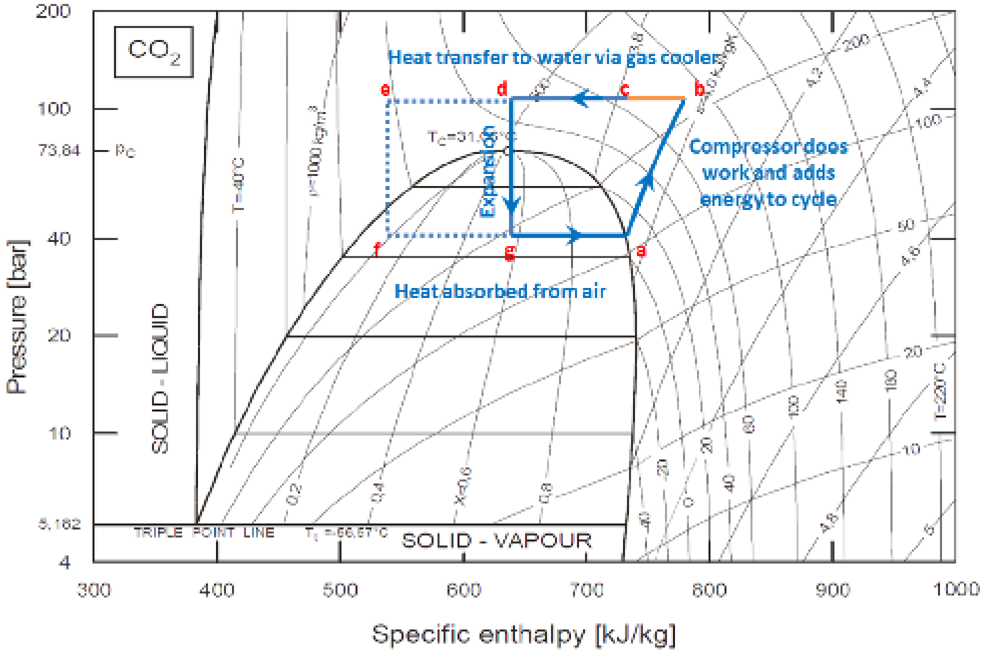
- Combination systems are complicated. Either in the piping layouts or the internal refrigerant circuits and system controls.
- Currently available stand alone HPWHs and space conditioning heat pumps work great and are reasonably priced. Why combine them into a necessarily more complicated device that has a lower efficiency and costs more?

- From Taco lab test findings: “Space heating efficiency for fan coil systems limited by need to keep supply air delivered to house hot enough. This leads to the HPU heating warm water (114 ^{o}F) most of the time which pulls down COP.”

Mismatches

- Space and water heating needs create a mismatch for current refrigerants
  - Water heaters raise 40-60F water to 125F
  - Space heaters operate with both supply and *return* temperatures above 100F
    - In-floor radiant heat can be lower
    - Forced air heating often hotter

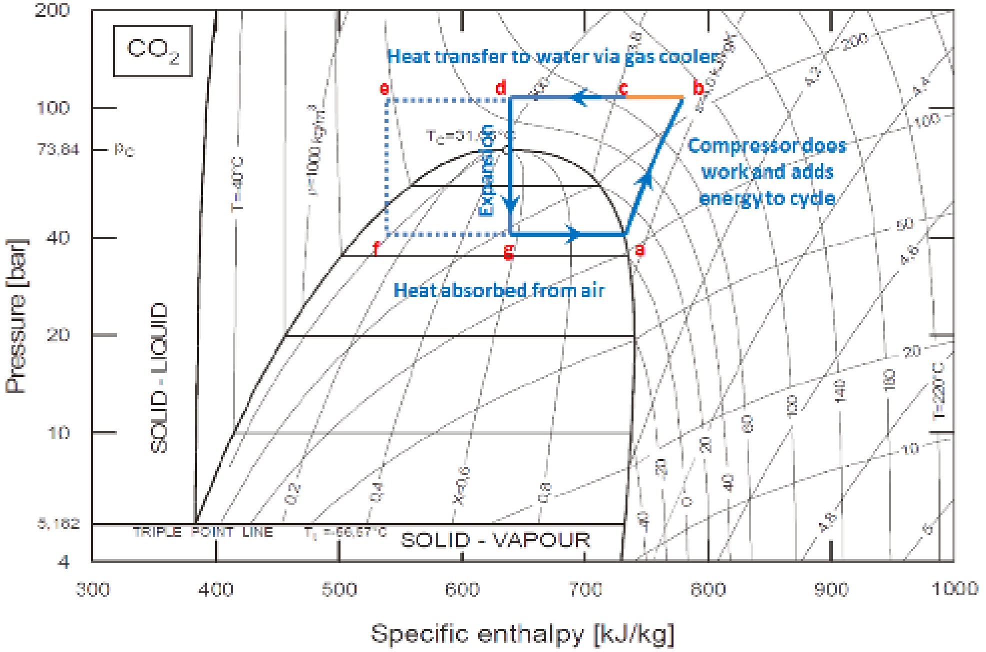
Figure 3. Idealized Transcritical Vapor Compression Cycle with Truncation



Typical Refrigerant Operating Ranges

- R-410a (current norm for space heating and cooling)
  - Minimum source air temperature -15F and below
    - Good for space heating
  - Maximum sink temperature around 120F. Sometimes hotter but it's limited by outdoor conditions.
    - Not so good for water heating. Refrigerant system is at max ability just where it is needed to make hot water.
- R-134a (current norm for water heating)
  - Minimum source air temperature ~30F
    - Not good for outdoor use
  - Maximum sink temperatures: well above 160F
    - Good for water heating
- CO_2 – Transcritical Cycle
  - Wide source air temperature range. Runs in cold weather
  - Heats water in single pass from very cold to very hot
    - Good for water heating (but not recirculation loops)
  - Efficiency drops and system components challenged to make already warm water hotter
    - I.e. heating water from 100F-120F is challenging and not so efficient
      - This is exactly the range for hydronic, force-air heating
- It's not just the refrigerants
  - The heat pump system components: compressor, evaporator, condenser, expansion valve, etc, all need to be selected for and controlled correctly across a range of operating temperatures

Figure 3. Idealized Transcritical Vapor Compression Cycle with Truncation



Gas Combi Systems

- Six installations in the Pacific Northwest
- Complicated installation and plumbing
- Positive results but not overly amazing
- Trades not familiar –
- No Airconditioning

Site 1

Before

After

10/27/2022

Site 2

Before

After

10/27/2022

Site 3

Before

After

Site 4

Before

After

Site 5

Before

After

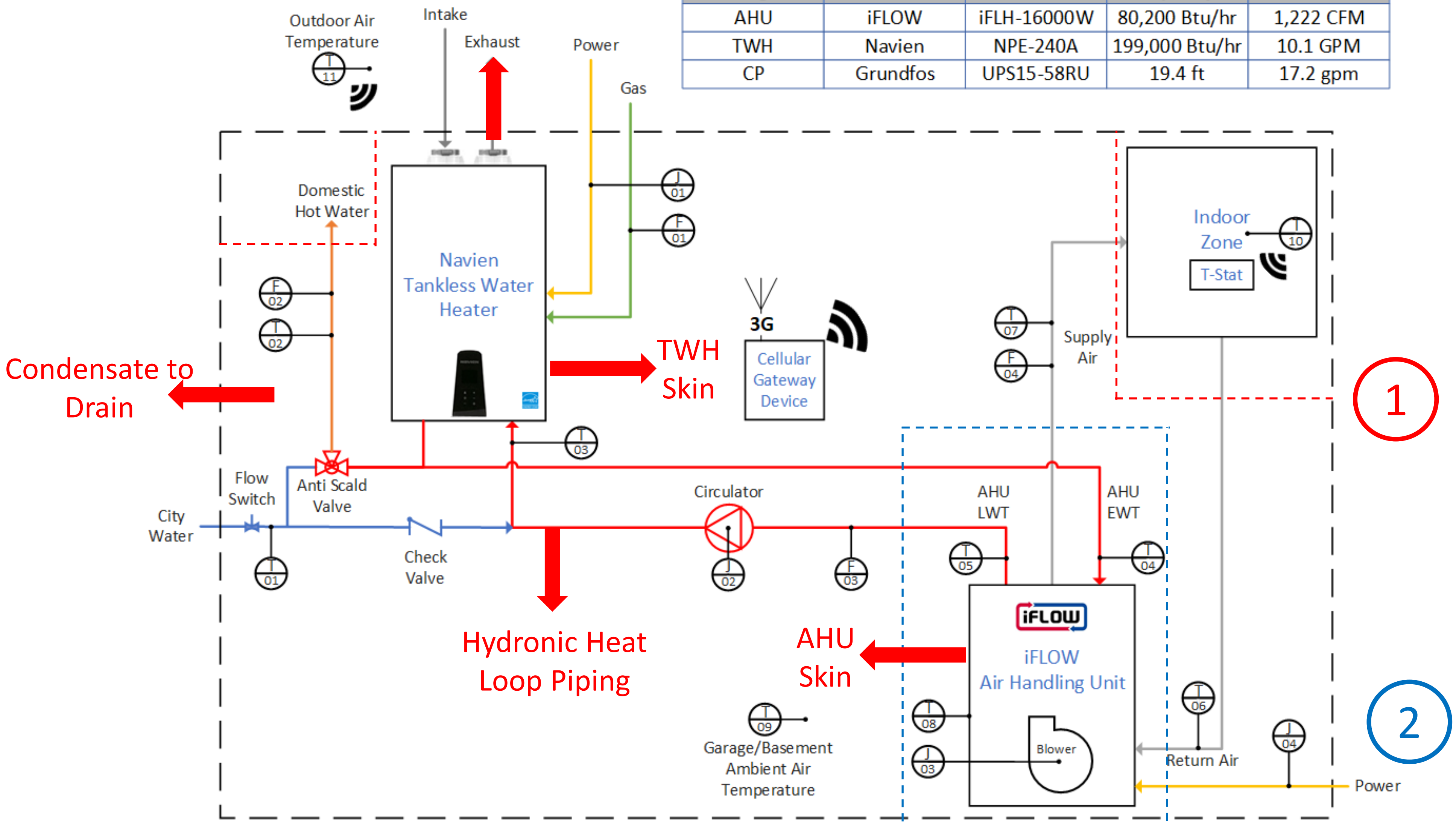
Site 6

Before

After

System Boundary

Combi Equipment Schedule				
Tag	Manufacturer	Model	Capacity	Flow
AHU	iFLOW	iFLH-16000W	80,200 Btu/hr	1,222 CFM
TWH	Navien	NPE-240A	199,000 Btu/hr	10.1 GPM
CP	Grundfos	UPS15-58RU	19.4 ft	17.2 gpm



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Field Efficiency Definition

$$[Eq\ 5.4]\quad Field\ Efficiency = \frac{Net\ Combi\ Heat\ Output}{Gas\ Input} = \frac{Q_{SH} + Q_{DHW} - Q_{shell}}{Q_{NG}}$$

Where:

Q_{DHW} = Heat output from water heater over a given interval [Btu]

Q_{SH} = Heat output from AHU over a given interval [Btu]

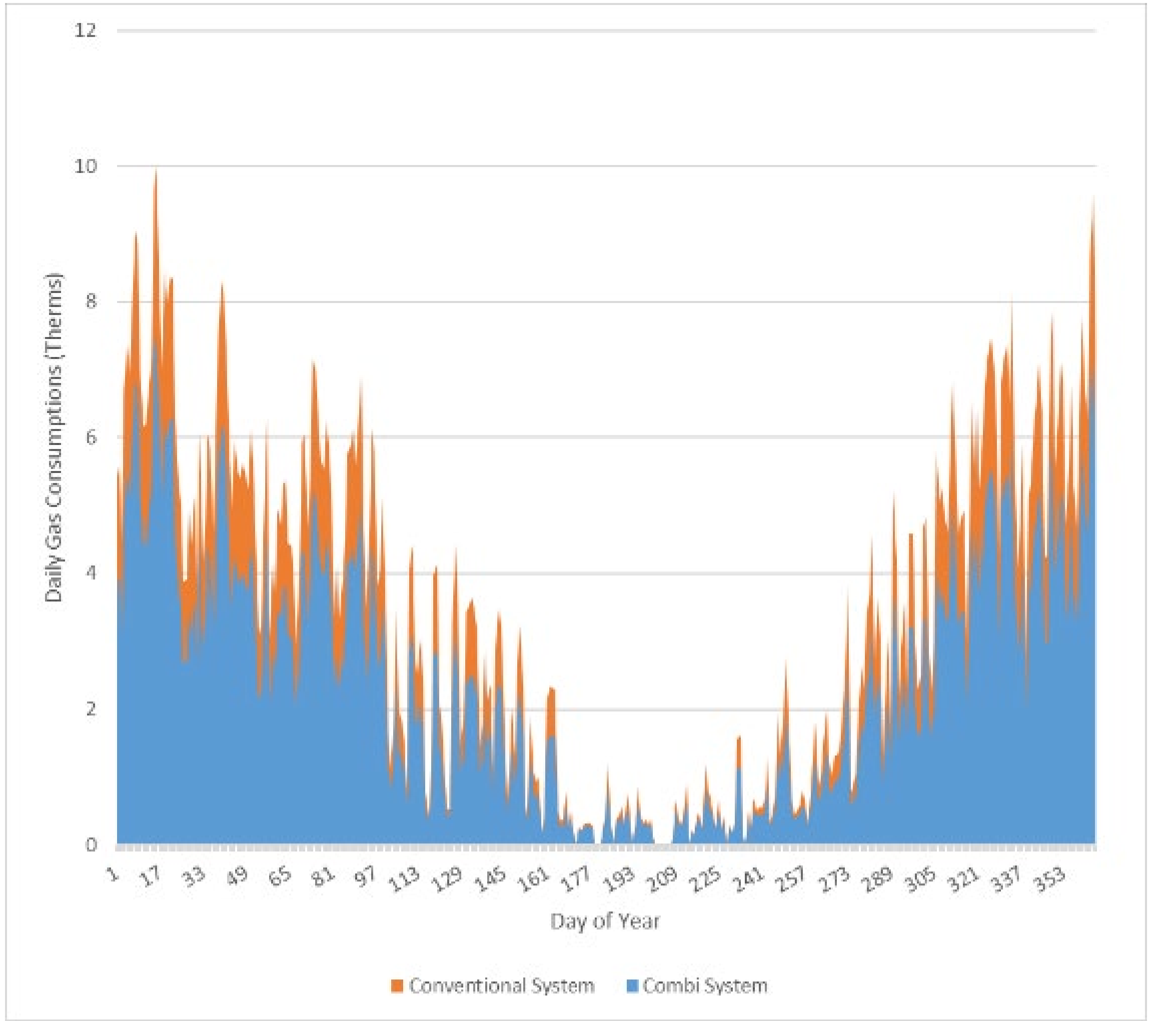
Q_{shell} = Heat loss from the AHU to the ambient (garage or basement) [Btu]

Q_{NG} = Energy input from natural gas [Btu]

Performance Results

- 87.4% annual field efficiency (avg.)
  - 81.8% to 94.7%
  - Similar for iFLOW & NTI

- 179 to 346 therms annual savings
  - 19% to 28% of total consumption
  - $122 to $257 annually
  - $10 to $21 monthly



Installer Experience

- Both iFLOW and NTI installations are more in-depth and require more coordination than conventional system replacements

- Packaged NTI requires less installation time and effort than de-coupled iFLOW system but is still more time and labor intensive than conventional like-for-like replacements

- Most residential contractors will be resistant to combi systems

User/Participant Experience

- **All participants reported high rates of satisfaction**
  – Same or better space heating (comfort)
  – Same or better hot water delivery

- **Longer installation time did not seem to be a barrier**

- **Unanswered questions**
  – How do homeowners think about replacing both systems at once when one may not be at end of life?
  – What would their preference be, combined (like NTI) or decoupled (like iFLOW)

Incremental Replacement Economics

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Conventional System Modeled	FAF + WH	FAF + WH	FAF + WH	FAF + WH	FAF + WH	FAF + WH
Conventional DHW UEF	0.62	0.62	0.62	0.62	0.62	0.62
Conventional Furnace AFUE	80%	80%	80%	80%	80%	80%
Conventional System Modeled Annual Efficiency	**66.4%**	**68.0%**	**65.5%**	**66.1%**	**65.4%**	**63.7%**
Conventional Annual Fuel (therms)	1,089	1,229	906	788	817	747
Combi System Tested	iFLOW	iFLOW	iFLOW	NTI	NTI	NTI
Combi System Modeled Annual Efficiency	**81.8%**	**94.7%**	**86.2%**	**91.0%**	**86.8%**	**83.8%**
Combi System Annual Fuel (therms)	885	883	688	573	616	568
Annual Natural Gas Savings (therms)	204	346	218	216	201	179
Annual Natural Gas Savings	19%	28%	24%	27%	25%	24%
Annual Avoided Cost of Gas	$152	$257	$201	$199	$137	$122
1 Simple Payback (years)	**27.9**	**14.3**	**30.2**	**21.7**	**23.7**	**26.6**

Summary and Contact information

- Sounds like a great idea
- Component efficiency looks good
- System and field efficiency is a challenge
- Complicated and messy installations
- Need to keep working with market for now
- For now, two independent systems – Space Heating and Water Heating are enough different

- Geoff Wickes Senior Product Manager, Emerging Technology at NEEA gwickes@neea.org
- Noe Contreras, Senior Product Manager Gas at NEEA, ncontreras@neea.org

- Thank you for your time!

Explore the Residential Program Guide

Resources to help improve your program and reach energy efficiency targets:

- Handbooks - explain *why* and *how* to implement specific stages of a program.
- Quick Answers - provide answers and resources for common questions.
- Proven Practices posts - include lessons learned, examples, and helpful tips from successful programs.
- Technology Solutions NEW! - present resources on advanced technologies, **HVAC** & **Heat Pump Water Heaters**, including installation guidance, marketing strategies, & potential savings.
- Health + Home Performance Infographic NEW! – spark homeowner conversations.

https://rpsc.energy.gov

Health + Home Performance Infographic

DOE's new Health + Home Performance Infographic reveals the link between efficiency and health – something everyone cares about. Efficiency programs and contractors can use the question-and-answer format to discover a homeowner's needs.

The infographic is ideal for the "kitchen table" conversations where people decide what to do – and who they want to do it. It also has links for homeowners to find a qualified contractor if they do not already have one.

Download this infographic from DOE's Better Buildings Residential Network.

Thank You!

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Please send any follow-up questions or future call topic ideas to:
bbresidentialnetwork@ee.doe.gov